R E P O R T R E S U M E S

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GENERAL BUSINESS UNIT, THE INFLUENCE OF AUTOMATION ON BUSINESS AND PERSONAL LIFE.

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DESCRIPTORS- *UNITS OF STUDY (SUBJECT FIELDS), *BUSINESS EDUCATION, HIGH SCHOOLS, *AUTOMATION, CURRICULUM GUIDES,

DEVELOPED BY A SPECIALIST IN BUSINESS AND OFFICE EDUCATION, THIS 6- TO 10-CLASS PERIOD UNIT IS FOR USE IN A HIGH SCHOOL BUSINESS EDUCATION COURSE. THE TEACHING OBJECTIVE IS TO DEVELOP AN UNDERSTANDING OF THE BASIC PRINCIPLES, THE SOCIAL AND ECONOMIC IMPLICATIONS, AND THE OCCUPATIONAL OPPORTUNITIES IMPORTANT IN AUTOMATION AND TECHNOLOGICAL CHANGE. SUGGESTED CONTENT, TEACHING-LEARNING ACTIVITIES, AND SUGGESTED REFERENCES ARE GIVEN FOR THE FOLLOWING SECTIONS -- (1) UNDERSTANDING WHAT AUTOMATION IS AND HOW IT INFLUENCES OUR DAILY LIVES, (2) TRACING THE HISTORICAL DEVELOPMENT OF AUTOMATION AND DATA PROCESSING, (3) UNDERSTANDING THE SOCIAL AND ECONOMIC IMPLICATIONS OF AUTOMATION AND TECHNOLOGICAL CHANGE (ITS INFLUENCE ON JOB LIFE AND WORKER EMPLOYABILITY), (4) BECOMING AWARE OF THE JOBS SPECIFICALLY RELATED TO AUTOMATION, AND (5) UNDERSTANDING THE BASIS OF THE ELECTRONIC COMPUTER AND PUNCHED-CARD EQUIPMENT. (FS)

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GENERAL BUSINESS

UNIT: THE INFLUENCE OF AUTOMATION ON BUSINESS AND PERSONAL LIFE

Major Teaching Objective

To develop an understanding of the basic principles, the social and economic implications, and the occupational opportunities important in automation and technological change

Learnings (Competencies) to be Developed

1. To understand what automation is and how it influences our daily lives
2. To trace the historical development of automation and data processing
3. To understand the social and economic implications of automation and technological change--its influence on job life and worker employability
4. To become aware of the jobs specifically related to automation
5. To understand the basis of the electronic computer and punched-card equipment

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GENERAL BUSINESS

UNIT: THE INFLUENCE OF AUTOMATION ON BUSINESS AND PERSONAL LIFE

Plan for Teaching Time

Group teaching:	Topic	Periods
In classroom, at school		
Outside classroom, at school		
Field trips, away from school		
	Total	

Individual Projects:

_____ _____

_____ _____

Month(s) to be taught _____

Place of the Unit in the Course of Study

Everyone's life is affected in some way by the use of automated equipment. A broader back ground is needed to enter the business world. Business saves time, money, and manpower by using data processing machines. Society receives better services at lower costs. Each of us must continually adapt to progress and continue his education to up date his skills throughout his employable life. These realities of modern society, government, business, and industry demand that the student have some basic understanding of automation and technological advance.

Since general business deals with business skills and knowledge important in everyday life, and gives the background for study of more advanced business courses, it is the appropriate course in which to include an exploratory unit on automation. The unit fits best near the end of the course, before the unit on "Successful Economic Citizenship," which deals with choosing a career and preparing for employment. Before this unit, the students should have a background of business services, a knowledge of business organization, and an understanding of his role as a producer and consumer. He will also have an awareness of a few automated and mechanical processes. This knowledge will facilitate his understanding of this unit.

A minimum of five to six class periods is suggested. The topic may be studied in greater depth by uses of special projects outside the classroom and the use of practice sets. Study time may be shortened by leaving the study of the specific job titles related to automation until the careers unit.

Suggestions for Introducing the Unit

Deciding What Is to be Taught

The content suggested is to provide the student with a general knowledge of automation. The study may be broadened to specific applications to office work by the working of a practice set, such as Automation Office Practice by Wanous and Wanous published by South-Western Publishing Company, or the use of a programmed text, such as Kahn's Business Data Processing published by Gregg.

The topics outlined for study in this unit are given briefly below. They are developed in greater detail in the unit.

a. What automation is and how it influences our daily lives

--Definition of automation

--Machines that are automated

--Difference between technology and automation

--Office equipment that is automated

--Factory machinery that is automated

--Examples of automation outside the business community

b. Historical development of automation and data processing

--Early inventions contributing to modern automation

--Development of computers

--Beginnings of automation in industry

--Factors influencing its growth

c. Social and economic implications of automation and technological change

--Effect on business

--Effect on employment

--Effect on office personnel

--Effect on school dropouts

--Assistance for workers in meeting the problems of technological change

--Effect on industry

--Expected social changes

d. Jobs specifically related to data processing

--Classification of jobs

--Preference toward men or women

--Basic requirements

--Some of the more common job titles

e. The electronic computer and punched card equipment

--Speed

--Uses

--Kinds

--How they solve problems

--How they do arithmetic

Presenting the Unit to the Class

The unit should be packed with realism and concrete examples. The following approaches or a combination thereof may be helpful in giving the class a clearcut first view:

a. Display pictures of computers. "Posters on Computers," a new bulletin board collection that covers computers from the abacus to the latest equipment in use, is available from J. Weston Walch, Publisher, Box 1075, Portland, Maine. It contains 18 posters, 8½ by 11 inches, printed on heavy-stock paper. Cost is $1.50 per set.

b. Display data processing equipment "software" for "hands on" experience. Obtain punched cards, program sheets, tapes, and data sheets from punched card and computer installations for the students to see and touch. A visit to a business using automated data processing will provide an opportunity to collect these. University and college computing centers and your own personal business transactions will yield examples for display.

c. Use films and/or filmstrips to give an overall view and to set the scene.

--"Have I Told You Lately I Love You," (16 min., sound, B & W, 20 min.), University of Sourthern California, Los Angeles, California; and University of California, Berkley, California.

This film tells the story of a modern family who are enslaved by automatic gadgets in home and business. They go through days with no real person-to-person contact because everything is done automatically. Emphasis is placed on life being more than a robot existence. The Machine Age's noncommunicative family life is dramatically and forcefully pointed out, even if somewhat exaggerated.

--"The Information Machine," (16 mm. or 35 mm., sound, color, 10 mm.), International Business, 590 Madison Avenue, New York 22, N. Y.; and local offices.

This is a sophisticated, sometimes amusing account of the development of the electronic computer beginning with primitive men and ending with the advent of machine simulation. Colorful and imaginative, this film is effective in explaining the nature of data processing. It is suitable for junior and senior high-school students and adults.

--"The Challenge of Electronic Data Processing," filmstrip, 87 frames, color, sound, 10 min.), The Association for Bank Audit, Control and Operation, 205 Touhy Ave., P.O. Box 500, Park Ridge, Illinois 60068.

This filmstrip explains the development of modern day data processing techniques and traces the history of record keeping from stone tablets to the computer. It explains what computers can and cannot do, how they may be used for business management decisions, and how they may be applied to large volume record keeping. Automation in banking is shown.

--"This Is Automation," (16 mm., sound, color, 30 min., rental $1), University of Georgia, Athens, Georgia; and University of Wisconsin.

Examples are given, ranging from the manufacture of cookies to cars. Some are complex (machining automobile engine blocks), and others are as simple packaging nuts and bolts. The film is produced by General Electric.

d. Use transparencies throughout the unit to illustrate important points.

--"Story of Computer," (Science No. 32). A pictorial presentation of computers and their abilities. Printed originals, Cat. No. 278, $1; prepared color transparencies, Cat. No. 778, $30. 3M Company, Visual Products Division, 2501 Hudson Rd., St. Paul, Minnesota 55119.

--See also transparency masters attached to back of this unit.

Learnings (Competencies) to be Developed

1. To understand what automation is and how it influences our daily lives.

This approach starts with the student's experiences and gives him a background on which to build understanding of the unfamiliar to follow. If one or more of the visual aids previously suggested is shown at the beginning of the class period, this discussion may serve as a summarization of important points.

Suggested Content

a. What is automation?

--Words sometimes used interchangeably with automation are: technology, technological change, mechanization, electronic data processing, scientism, electronics, and advanced instrumentation.

--A general definition often used "any mechanical device or system which reduces mental or manual effort," actually defines technology or mechanization.

--Technology includes mechanical or electro-mechanical devices which are paced and controlled by men who operate them as well as machines that are automatic or self-directed.

--A more accurate definition of automation is the repetition of machine functions through self-directed control. This embraces the principle of feedback or self-correction.

b. What are some machines that control themselves?

--Some examples are the transfer machine in a Detroit automobile factory, the control panel in an oil refinery, and the electronic computer in the business office.

--The amount of work produced is not limited by the abilities of the human operator, but by the capabilities of the machine itself.

--The operator provides the machine with its instructions or program; but once these have been given, the machine is self-acting.

c. What are some machines that are self-correcting?

--Two devices that are self-correcting are a windmill and a heating system controlled by a thermostat.

--The wind turns the mill which lifts the water. When the wind changes direction, the tail fan repositions the fan wheel so

that it continues to face into the wind. Because of this automatic control, the mill can pump water for years without interruption.

--When the heating system in a home is thermostatically controlled, the thermostat tells the furnace to return the room to the desired condition when the temperature gets too high or too low. The correct temperature is thus maintained through feedback; that is, through the furnace feeding back the heat needed to return the room to the desired temperature. The furnace is self-directed, no human effort is required unless a different temperature is desired.

d. What does one think of first when he hears the words technology and automation?

--One thinks almost immediately of the computer.

e. Is there other equipment in the business office that falls in these catagories?

--Yes, there are typewriters, desk calculators, duplicators, integrated data processing equipment, and punched-card equipment.

--This equipment can keep inventory records, compile sales figures, handle payroll accounts, prepare income tax returns, and make time studies. Some can even translate languages. Railroads and airlines use it for making seat reservations. A central computer keeps a record of available space on future flights. All flight and seat information is stored in coded form in its memory unit. When a ticket agent pushes a series of buttons, the computer checks its memory unit and tells the agent whether a seat is available on a particular flight. The agent can then reserve the seat by pushing another series of buttons. The reservation systems of several airlines can be interelated on one network.

f. What equipment do factories have of this type?

--They have machines which perform operations, control operations, move materials from one operation to the next, inspect products, maintain inventories, and fill orders.

--Since this type of automation is much used in the automobile industry it is often referred to as "Detroit Automation."

--An example is the application used by the Ford Motor Company, Cleveland, Ohio. It processes complete engine blocks with automation. It takes only 14.6 minutes for a series of 530 automatic operations to produce finished products. The key unit in the system is the toolmeter, a tool control board which looks like a big switch board and tells the operator

when to replace worn tools in the engine-block line. A light flashes on at the moment a tool needs changing. It can be replaced without halting production.

g. Is automation confined to the business community only?

--No, the armed forces, have guided missiles, space vehicles, supersonic aircraft, and automatic atomic submarines. Computers were used in preparing Telstar and placing it into orbit.

--The home has automatic washers and dryers, stoves with control panels that resemble the cockpit of a jet airliner, and electric can openers.

--Automobiles may have automatic transmissions, power windows, brakes, and steering.

Teaching-Learning Activities

a. Ask the students for their own definition of automation. Make it a part of a bulletin board display, with pictures of automatic machines.

b. Ask the students to list, from their own experience, all the mechanical devices they can that reduce physical or mental human effort. Record these on the chalkboard.

c. Ask the students to list as many devices as possible that are self-directed.

d. Have the students list what they would like to learn about automation. Use these items in planning future lessons.

e. Alert students to the timeliness and importance of automation by having them bring to class for discussion at least one article from a newspaper or magazine concerning some phase of automation.

f. Have the students keep a vocabulary notebook of automation terms. From this lesson they may define the following:

automation	data processing
technology	computer
electro-mechanical	"Detroit Automation"
feedback	

g. Have students bring evidence to class to show that automated equipment is being used in business. (punched tags on clothes, punched card bills, mark sensed credit card receipts, etc.)

Suggested References

a. For the student

--"Data Processing and Introduction for Students: What Is Data Processing All About?" by Merle W. Wood and Robert G. Espegren. An article published in the October, 1964, issue of the Business Education World, pp. 15-18. Reprints are available at 50¢ per copy (26-50 copies cost 45¢ each; 51-100 copies, 40¢; 101 and over, 35¢). Write: Reprint Department, Business Education World, 330 W. 42 St., New York, N. Y. 10036.

--"Electronic Data Processing Written for the Layman: Book 1. What Is Data Processing?" National Cash Register Company, Dayton, Ohio. Free.

b. For the Teacher

--Data Processing for Business Education Department in Pennsylvania's Public Schools (Bulletin 276). Department of Public Instruction, Commonwealth of Pennsylvania, Harrisburg, Pa. Free. pp. 6-17.

This booklet has been prepared to give business teachers a background in data processing. Most of the information can be used as a reference in preparing daily lesson plans. It explains what rather than how.

--"Automatic Data Processing Glossary," U. S. Government Printing Office, Washington, D. C. 20402. 40¢

--"Automation Dictionary," Minneapolis-Honeywell Regulator Co., Information Service Department, 60 Walnut Street, Wellesley Hills, Massachusetts 02181. $1

2. To trace the historical development of automation and data processing.

Since work began, man has tried to reduce his efforts through use of tools and machines. Notable inventions through the centuries which have lead to today's electronic computers and automated factories are the wheel, pulley, levers, steam power, gas power, electrical power, conveyor belts, and assembly lines. Some developments more directly related to modern day automation and data processing with which the student should be acquainted are given below:

Suggested Content

a. What were some early related inventions which lead to the development of modern automation?

--The ancient Greeks, Romans, and Chinese developed and used the abacus as a counting device. It is still in use today.

--Blaise Pascal, a famous French mathematician and philosopher, built some "arithmetic machines" 1642-1643.

--Jacques de Vaucanson, a French inventor, built a mechanical loom for manufacturing figured silks in 1741. Its pedals were moved automatically by means of a drum pierced with holes.

--Oliver Evans, an American inventor, built a completely automatic flour mill near Philadelphia in 1784.

--James Watt invented and used a flyball governor, a feedback device to control the speed of his famous invention, the steam engine.

--Joseph Marie Jacquard, a Frenchman, adapted De Vaucanson's ideas into an automatic loom operated by punched cards much like those used in today's electronic office machines in 1801.

b. When were computers developed?

--Business data processing, a product of the nineteenth century, came into being in 1822 when Charles Babbage developed a "different engine" for calculating mathmetical tables. Later improvements lead to the first internally stored program computer in 1833.

--Some feel that the work of Dr. Herman Hollerith beginning in 1887, the application of punched cards in recording, compiling, and tabulating the 1890 U. S. Census, is more significant as a beginning date for business data processing. By 1900 Hollerith had developed an automatic electric sorting machine that could sort at the rate of 300 cards a minute, a semi-automatic unit tabulator, and a key punch machine. Later he left the Census Bureau and formed the Tabulating Machine Company, out of which emerged Remington Rand Corporation and IBM, today's top computer manufacturers.

--In the 1940's electronic computers were developed and used to solve acute military problems such as gunfire control. The winning of World War II can be attributed in some measure to their use.

--It wasn't until after 1950 that computers were used for the solving of problems outside the fields of engineering and science.

--The first all-electric computer was developed by John W. Mauchly and J. Presper Eckert at the University of Pennsylvania (1943-45). Their efforts lead to the development of the Univac, which became the world's first commercial electronic data processing machine. It was made available commercially in 1951. A significant feature of Univac over its forerunners was its ability to handle alphabetics and certain typewritten characters as well as numerics.

--In 1952 the eyes of the American people were opened when a computer, after receiving some early returns of the Presidential election between Eisenhower and Stevenson, accurately predicted the outcome of the election.

--By 1954 the first computer was installed in private industry. Another development during the 50's was the introduction and use of medium-sized and small computers. Small computers generally cost less than $50,000; medium-sized computers cost from $50,000 and $500,000; and large computers over $500,000.

--Early computers were operated by means of vacuum tubes which were bulky and demanded considerable power. Early in 1964, tiny transistors were used in their place. This was a considerable step forward since these units require less power and occupy less space in the computer.

c. Where and when did automation begin in industry?

--Electronic devices were first adapted for use in factories during the production boom following World War II.

--The automobile industry was the first major industry to make widespread use of automatic machines.

--Automatic control systems were developed to regulate chemical and oil-refining processes. These systems greatly increased the quality and quantity of the products produces.

--By 1954 automatic machines were producing television sets.

d. What factors have influenced the growth of automation?

--The increased needs created by our tremendous population growth and greater per-capita demand for consumer goods have been factors.

--American business and industry are trying to reduce per unit costs to offset what management views as excessive labor wage rates. This is to prevent loss of profits.

--Many U. S. businesses are trying to cut costs in order to compete with foreign producers in both domestic and foreign markets.

--The increasing demand of government for more records (income tax, unemployment benefits, social security) has accelerated the introduction of automation in the business office.

--Other factors are increased competition, increased complexity of products, and the demand by management for more quantitative information to aid in decision making.

-- Generally, the need is to produce more information faster than ever before.

Teaching-Learning Activities

a. Demonstrate the abacus.
b. Discuss the industrial revolution and why automation is sometimes called the second industrial revolution. Contrast the operation of the machines developed in each.

c. Discuss the history of the typewriter as an example of the impact of machines on work in the business office.

d. Demonstrate sorting cards with a keysort to show how a simple mechanical device will save time and effort.

e. Illustrate the window envelope as a simple automated device.

f. Have the students add the following names and terms to their automation vocabulary list:

Blaise Pascal	abacus
Jacques de Vaucanson	vacuum tubes
Oliver Evans	transistors
James Watt	industrial revolution
Joseph Marie Jacquard	second industrial revolution
Charles Babbage	IBM
Dr. Herman Hollerith	Univac
Remington Rand	

Suggested References

a. For the student

-- Read articles in encyclopedias on automation, the industrial revolution, and the typewriter. Reports may be prepared on these subjects.

b. For the teacher

-- Data Processing for Business Education Department in Pennsylvania's Public Schools, pp. 18-20.

-- "Automation: A Must Unit for General Business," by Gunder A. Myran, pp. 6-9, 31-32. Business Education World, Vol. 43, June, 1963.

3. To understand the social and economic implications of automation and technological change.

In the long-run, automation is expected to increase production, give us more and better jobs, and improve our standard of living. As we

look around us, we see that these blessings are coming, but not without making old jobs obsolete and eliminating the demand for certain skills. A willingness to work and a strong back are no longer good enough even for many "unskilled jobs." In order for the high-school student to understand the ramifications of data processing, he should know the effect it has on the business world, on present and future employment, on present and prospective office employees, and on his future, especially if a high-school education is not attained.

Suggested Content

a. What has been and will be the effect of data processing on business?

--In inquiry and reply--preparing and sending letters, reports, memorandums, etc.--where ability to make decisions is needed, data processing may not offer much relief.

--In the field of recordkeeping, it is changing not only the work being done but also the jobs of those employed. The magnitude and complexity of business, government reports, increasing payroll deductions, limited supply of properly trained clerical workers, and the demand for better services have increased the volume of office work so manual and mechanical filing, collecting, and retrieving information is no longer possible or desirable.

--It allows management to receive the information needed to make decisions shortly after the close of the quarter, month, or year. With manual processing, management would often receive their report for one month at the end of the next month. Punched card equipment speeded up the process to the middle of the next month but the computer made this information available the second day of the following month.

--More businesses have access to computers. Cheaper and more compact computers are available which are now within the reach of small businesses. Service bureaus and cooperative data processing centers have been established by firms with similar operations.

b. How will data processing affect employment?

--A 45 percent increase in clerical workers is expected between 1960 and 1975. This is how the second largest occupational group in the nation employs about 10.5 million people. The rate of growth is increasing faster than the work force as a whole. This is true irrespective of the development and use of office machines that can do work in minutes that formerly took weeks to accomplish.

--Sixty million jobs will change in character in the next generation. There will be many new jobs created that have not previously existed.

--It will not be necessary to hire a large number of temporary employees for short periods of time.

--The percentage of factory workers will decrease and the percentage of office and laboratory workers will increase.

--The managerial, technical and professional groups are rapidly overtaking the semi-skilled machine operator groups in employment.

c. How will office personnel be affected?

--Some employees will have to be retrained. Others will have to broaden their background and gain additional understandings and competencies.

--Fewer employees will work in accounting departments in branch offices and a greater number will be employed in a centralized office. Banks with suburban branches are examples of this. Often a person working in a branch office does not want to move to a centralized office of the same company.

--The percentage of men working in offices will increase. Women do not like to work at night, and computers will be operating 24 hours a day because of their high rental.

d. What happens to those who drop out of school?

--Competition in many entry occupations, especially lower level clerical jobs will increase. Vocational competency will be needed to acquire, adjust to, and move ahead in a job.

--There will be fewer jobs for those who have little formal academic or vocational education. Clerical jobs requiring no specific skill are found only in offices that haven't automated. Work that involves repetitive or routine tasks is disappearing from the business office because it is being done by machines.

e. What is being done to help workers meet the problems caused by technological change?

--Government programs are increasing unemployment benefits.

--Industrially depressed areas are being redeveloped (Area Redevelopment Act).

--Programs of retraining unemployed and underemployment workers are being initiated (Manpower Development and Training Act).

--New educational and training programs are becoming available in schools, colleges, and industries. For example, The Armour

Company has set up a fund for studies to find opportunities for employment for workers displaced by automation and to inaugurate training programs. One cent per hundred pounds of meat shipped is contributed to this fund.

--Displaced workers may be moved to other industries.

f. What influences the economic effect automation will have from industry to industry?

--The kind of automation technique being employed--electronic data processing, Detroit automation, process control, or machine tool control--influences the increase or decrease in the number of workers and how old employees will be integrated in the new systems.

--The strength of labor-management relations often decides the welfare of the employees.

--The versatility of the work force, age levels, and education levels are influential. Some employees may not be capable of learning the new skills that would be required of them.

--Some companies may need more workers because they are able to turn out a better product at lower prices.

g. What social changes can we expect?

--Automation is the key to a shorter work week. There is an unmistakable trend toward less work and more leisure. Forced idleness or unemployment should be avoided. Will we be able to adjust to having more leisure time?

--Automation brings about lower prices.

Teaching-Learning Activities

a. Discuss the effect of data processing on office work, in terms of communication and recordkeeping.

b. Describe how management depends upon data processing.

c. Discuss the effect of data processing on office employment.

d. Discuss reasons why the installation of a computer eventually necessitates the hiring of a greater number of clerical employees.

e. Obtain U. S. Department of Labor employment statistics for discussion.

f. Invite a representative of the state employment service to discuss employment trends.

g. Invite a representative of a large factory to discuss automation and employment in his plant.

h. Have your school's guidance counselor discuss curriculums designed to meet the demands that society and the business world will impose on the student.

i. Have students be on the alert for magazine articles and newspaper accounts of the effect of automation on employment.

Suggested References

a. For the teacher

--Data Processing for Business Education Departments in Pennsylvania's Public Schools, pp. 22-28.

--"Automation (Implications for the Future)," edited by Morris Philipson, (V-46, $1.95). Vintage Books, Random House, Inc., New York, New York.

This pocketbook contains a series of articles in the implications of automation for industry, labor, theory, government, the social sciences, education, and leisure. Each article is written by a specialist in the field and each is very enlightening. There are eighteen articles in all.

--Adjustments to the Introduction of Office Automation (Bulletin 1276, $.50). Published by the U. S. Department of Labor. Superintendent of Documents, Washington, D. C. 20402.

This is a study of some of the implications of the installation of electronic data processing in 20 offices in private industry, with special reference to older workers.

Instructional Materials

a. Films

--"Technology and You," (16 mm., sound, color, 13 min.). Rental $4.50. University of Michigan, Ann Arbor, Michigan; and University of Wisconsin, Madison, Wisconsin.

Technology is defined. Examples of its application in transportation, architecture and automation; its use in electrical, atomic and solar power; and its use in research are given. Vocational opportunities for students and the importance of preparation for employment are emphasized.

--"Technique for Tomorrow," (25 min., B & W). Produced by Ford Motor Company. Available from Business Screen Magazines, Inc., 7064 Sheridan Road, Chicago 26, Illinois.

Automatic control of machinery and the mechanical transfer of materials are described as a modern industrial revolution. The positive results of automation are shown to be high productivity with less human effort and a new standard of living for all.

b. Transparencies (See masters attached at back of unit.)

4. <u>To become aware of the jobs specifically related to data processing</u>.

There are many jobs that are automated or affected by automation. In this unit, however, study will be confined to job titles directly related to automation. This portion of the unit could be combined with a careers unit, rather than being included at this time.

<u>Content to be Included</u>

a. How are automated (computer orientated) jobs classified?

--Computer orientated jobs may be classified as professional technical, and clerical.

--The professional require four years of college or the equivalent, the technical require six months to two years of post high school education or equivalent, and the clerical require a high-school education or equivalent.

--Some positions cross categories.

b. Are men likely to be given preference to women for these positions?

--Yes, men may be given preference in hiring.

--The expense of renting or purchasing equipment is heavy and computer installations are frequently operated 24 hours a day.

--Men are more likely than women to remain in a position for a longer period of time after they have been trained for their job.

--They are more willing to work at nights because of family obligations.

--Labor laws in some states restrict the number of hours and the time of day that women may work.

c. What are some of the basic requirements for the jobs?

--Since one error can be carried through an entire process and make the end result worthless garbage, accuracy in reading, figuring, speaking, spelling, and writing is a must.

--Skill to operate a typewriter and a keypunch is necessary since these are basic machines to the system.

--A knowledge and understanding of bookkeeping and accounting, business organization, filing, and business communications (including mailing procedures, office procedures, business forms, and reference materials) is especially helpful.

--Some general characteristics a person must have in addition to knowledge are: the ability to see relationships, maturity to judgment, ability to analyze problems before solving them, efficient work habits and methods, good business ethics, and ability to adapt to change.

d. What are some of the common jobs? (See Dictionary for Occupational Titles for addition information. Reference numbers are given.)

--Key punch (card punch) operator. (D.O.T. 1-25.62) A keypunch operator must be able to type with a high degree of accuracy. He will find a knowledge of ten-key adding machine operation helpful as his machine's keyboard combines the features of both the electric typewriter and the ten-key adding machine.

His job includes typing (punching) data from source documents such as sales slips and time cards into punched cards. He is responsible for loading and unloading the machine, preparing program cards, and detecting faulty operation. He may also operate other unit record equipment. It takes about a week of intensified training to learn the fundamentals for this position and about 120 hours to develop vocational competency.

--Peripheral (auxiliary or unit record) equipment operator (D.O.T. 1-25.60 and 1-25.98). This person is responsible for operating all the machines that prepare material for the computer. He may not be required to operate a key punch, but in some installations he may be called upon to wire a control panel.

About six weeks of specialized training is required. The operator must be able to identify incorrectly punched cards or tapes and recognize situations which might cause the system not to operate properly. If he desires to advance to computer-operator, he needs a knowledge of accounting, algebra, business organization and management, and data processing principles.

--Console (Computer) operator (D.O.T. 1-25-17). The computer operator's chief function is to put into operation the instructions given by the programmer and to operate the computer while it carries out these instructions. If the computer stops running, gives faulty information, or needs new directions, he may type-in new instructions. He needs the ability to think rapidly and make quick decisions as he must do his work while the computer runs. About two to six months of concentrated training is necessary to maintain this position.

--Tape librarian (D.O.T. 1-20-04). The tape librarian maintains files of magnetic tapes, punched cards, paper tapes, and decks of punched cards for use by the console and auxiliary equipment operators. She prepares a reference card for each set which gives the information contained, purpose of the program, and date generated.

A knowledge of filing, accuracy, and ability to get along with others is important in this position.

--Programmer (D.O.T. 0-69.981). The programmer prepares the instructions for the computer. He first determines what information is needed and from whom it may be obtained. He then prepares a complete description of the job in the form of a flow chart or block diagram. From this the instructions are converted into machine language. He also organizes and directs the people who do the work.

He must have a general knowledge of business organization and management, plus a specific background in the business in which he is working. He must also have a knowledge of algebra, and a thorough understanding of the machine functions and characteristics on which he is preparing a program. He needs an insight into both computers and unit record equipment.

--Systems analyst (D.O.T. 0-69.985). The systems analyst coordinates the work of the other departments with the data processing facility. This is one of the most responsible data-processing positions.

Teaching-Learning Activities

a. Refer to a copy of the Dictionary of Occupational Titles with the class to locate other automation job titles.

b. Invite someone who works with data-processing equipment to describe his work to the class.

c. Visit a computing center to observe people at work in data-processing activities.

d. Discuss places where one may prepare for or receive training in data-processing work. Have students study college catalogues, business offerings, area vocational school offerings, and company training ads in newspapers.

e. Have the students prepare a block diagram of how to work a long division problem, how to get home from school, how to study, etc., to illustrate the planning phase of the programmer goes through in doing his work.

f. Add the following to the vocabulary notebook:

professional	console operator
technical	tape librarian
clerical	programmer
key punch operator	systems analyst
peripheral equipment operator	computing center

References

a. Business Data Processing, pp. 67-70.

b. Understanding Modern Business Data Processing, pp. 282-299, (Excellent illustrations with each description).

c. Dictionary of Occupational Titles

d. Data Processing for Business Education Departments in Pennsylvania's Public Schools, pp. 39-45.

Instructional Materials

a. Films

--"Careers in Business Data Processing," (16 mm., sound, color, 13 min., $5 rental). University of Southern California, Los Angeles, California.

--"Computer Programming," (16 mm., sound, 26 min.). System Development Corporation, 2500 Colorado Avenue, Santa Monica, California.

A good film to show to logically minded programmers or those interested in knowing what a programmer does.

b. Transparencies (See masters at back of unit.)

5. **To understand the basis of the electronic computer and punched card equipment**

This learning deals with only a general overview of computer operation. It is provided in order that the student may gain an insight into the capacity of an automated device and because computers and automation are synomymous in the minds of many. It will also assist students in developing a background for the study of electronic data processing as it applies to office work.

Content to be Included

a. What are computers?

--They are electronic or mechanical devices that solve mathematical problems and perform clerical tasks.

--They can add, subtract, multiply, and divide.

--Although they are sometimes referred to as electronic brains, they lack the ability to think out things for themselves. All they can do is carry out the instructions that their human operators give.

b. How fast do they operate?

--Their electronic circuits can act 1,000 times faster than a nerve cell in the human brain.

--They can do 8,000 additions or subtractions in one second. They have solved in one minute a problem that would take a man 2½ years to figure with pencil and paper.

c. How are they being used?

--Business uses them to prepare payrolls, write bills for customers, do accounting, take dictation, write letters, read incoming mail, figure taxes, keep inventories, keep records of deposits, and keep records of subscriptions.

--Manufacturing uses them to control the flow of oil through tanks and to transfer mixtures from one processing vat to another. Other uses are to run machines and control production lines in some automobile plants and factories.

d. What kinds are there?

--There are two basic kinds: digital and analog.

--Digital computers give results by counting numbers. The numbers can be used to represent anything that can be measured. These computers are used by industries and business firms to make precise calculations and are the most widely used of the two types. They can do arithmetic and such logical operations as comparing, selecting, matching, and sorting information. Some simple digital computers are our hands, the abacus, and cash registers. They determine how many.

--Analog computers are faster than digital computers but are less exact. They are used frequently by scientists for research projects that do not require highly exact solutions. They must be designed to fit the needs of the particular problem to be solved. They are built to be an analogy or physical likeness of the problem that they are designed to solve, but they may use far different physical qualities to arrive at their solution. Simple analog computers are clocks, thermometers, and weighing scales. They determine how much.

--Our discussion will be confined to digital computers.

e. How do computers solve problems?

--Let's think first of how an individual solves a problem with a calculator. (1) He has the calculator to do his arithmetic. (2) He has a piece of scratch paper to keep track of intermediate steps and the order of work. (3) He has tables to calculate square root, interest, etc. (4) His mind controls the entire operation.

--The computer has (1) an arithmetic unit to correspond to the calculator, (2) a control unit to direct the operation and keep track of the steps, (3) a control memory or storage unit to take the place of the reference book of tables, (4) input units to give the right kind of information, and (5) output units to provide the result obtained to its human operators.

--The arithmetic unit performs all the computations. It does adding, subtracting, multiplying, and dividing. In addition it makes such logical decisions as distinguishing between positive, negative, and zero values. It can tell whether one value is greater than, less than, or equal to another value.

--The control and unit directs and coordinates the entire system as a single multipurpose machine. It takes data from storage and operates on instructions given by the programmer.

--The storage or memory unit is like an electronic filing cabinet. It may be a part of the computer system or an auxiliary device such as magnetic disks, drums, and tape.

--The input unit accepts the initial information required to solve the problem. It can receive information from punched cards, paper tape, magnetic tape, magnetic ink characters, or from the typewriter keyboard connected to the computer.

--The output unit give the results of the computer operation. It may give the results on cards, magnetic tape, paper tape and/or printed or typed forms.

f. How do computers do arithmetic?

--Computers have thousand of circuits, resembling electric-light switches, that can be either off or on indefinitely.

--They make use of the binary system in solving arithmetic. This is a two-digit system using one 1 and 0; one is represented by on; zero by off. These are referred to as bit values. Combination of 1 and 0 can be used to represent any number letter or symbol that is to be handled by the computer. Single and multiple-digit decimal numbers are expressed by the position of the bit symbols (1 and 0) which are based on the progression of powers of two: the unit position of a binary number has the value of 1, the next 2, the next 4, the next 8, etc.

Decimal Number	Binary Coded Decimal (Binary Value)							
	128	64	32	16	8	4	2	1
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
4	0	0	0	0	0	1	0	0
8	0	0	0	0	1	0	0	0
16	0	0	0	1	0	0	0	0
32	0	0	1	0	0	0	0	0
64	0	1	0	0	0	0	0	0
128	1	0	0	0	0	0	0	0

Decimal Digit	Binary Notation
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

On the basis of place value, the following decimal numbers would be expressed:

Decimal Number	Binary Equivalent
15	000001111
96	001100000
130	010000010

Teaching-Learning Activities

a. Have students prepare a punched card showing their name, address, and telephone number. Have them mark off the card in fields and "black-in" the spaces where the holes would be punched.

b. Obtain a mathematics textbook and have the students work addition, subtraction, multiplication, and division problems using binary arithmetic.

c. Visit a business which uses data processing to do accounting.

d. Have the students add the following to their vocabulary study:

computer	bits
digital computer	binary arithmetic
analog computer	paper tape
arithmetic unit	magnetic tape
control unit	punched card
storage unit	nine edge
input unit	twelve edge
output unit	zone punch

References

a. For the student

--"Book 3: What is EDP," National Cash Register, Dayton, Ohio 45409.

--"Book 2: What is Binary Arithmetic?" National Cash Register, Dayton, Ohio 45409.

--Encyclopedia articles on the computer.

b. For the teacher

--Data Processing for Business Education Department in Pennsylvania's Public Schools, pp. 55-89.

--Business Data Processing, pp. 34-66.

--"Automatic Digital Computers," Los Alamos Scientific Laboratory, Public Relations Office, P.O. Box 1663, Los Alamos, New Mexico 87544. Limit of 100 copies. Free.

--Understanding Modern Business Data Processing, pp. 64-191. (Has excellent illustrations.)

--General Information Manual: Introduction to Data Processing Systems, (F22-6517). IBM, Data Processing Division, 112 East Post Road, White Plains, New York.

--Applied Business Mathematics, "Section 79: Binary System of Numeration," pp. 487-494.

--20th Century Bookkeeping and Accounting, "Appendix A: Automation in Bookkeeping and Accounting," pp. 511-524.

Instructional Materials

a. Films

--"What is EDP?" (15 min., color, 16 mm.) International Business Machines, Data Processing Division, White Plains, New York. (Free--call local representative.)

This film discusses the basic principles of electronic data processing. It explains the provisions for input, storage, processing, and output of data. It deals briefly with punched cards, paper and magnetic tape, magnetic ink, and magnetic drum, disk, and tape storage. It is designed for those of high school level and above who have some interest and background in the subject.

b. Transparencies (See masters at the back of the unit.)

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Adjustments to the Introduction of Office Automation (Bulletin 1276). U. S. Department of Labor, Washington, D. C.: U. S. Government Printing Office, 1960.

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"Electronic Data Processing Written for the Layman"
Book 1: What is Data Processing?
Book 2: What is Binary Arithmetic?
Book 3: What is EDP?
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Kahn, Gilbert. Business Data Processing. New York: Gregg Publishing Company, 1966.

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